Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 1997		**00-00-1997 to 00-00-1997**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
High Performance Computer Models in Computational Acoustics	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Yale University,Department of Computer Science,P.O. Box 208285,New Haven,CT,06520-8285**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a REPORT **unclassified**	b ABSTRACT **unclassified**	c THIS PAGE **unclassified**	**Same as Report (SAR)**	**2**	

HIGH PERFORMANCE COMPUTER MODELS IN COMPUTATIONAL ACOUSTICS

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Award # N00014-96-1-0442
Category of Research: shallow-water acoustics

LONG TERM GOALS

Our goal is to develop accurate models and efficient algorithms for the numerical solution of wave propagation problems for Navy applications.

OBJECTIVES

Through our continued collaboration with Dr. Ding Lee, our objective is the development of a 3-dimensional coupled wave propagation model in a fluid-elastic environment.

APPROACH

In previous years, the Computational Ocean Acoustics group at Yale has contributed through the design and analysis of new numerical schemes, the enhancement of the FOR3D code, and its implementation on parallel machines. The fluid-elastic model will be considered an important extension of the code. We continue to work with Dr. Lee in the development and analysis of the mathematical model. Issues that require special attention include the numerical implementation of the solution to a complex system of differential equations that results from a parabolic approximation of the problem, stability analysis and efficient implementation.

WORK COMPLETED

In recent fiscal years, the group at Yale contributed through the design and implementation of fast algorithms for PE approximations and the development of parallel algorithms and their implementation on parallel supercomputers.
During the last two fiscal years, the group has made important progress in the modeling of fluid/elastic interface, and the formulation of a coupled 3D fluid-elastic mathematical model in ODE form which can be incorporated to the coupled 3D fluid-elastic interface model.
We completed the mathematical formulation of a parabolic approximation of the fluid-elastic interface conditions, making them compatible with the parabolic fluid and elastic equations. This was an important step in combining the fluid and elastic models into a

coupled system of parabolic differential equations. We continue to collaborate with Dr. Lee in the development and analysis of numerical techniques to solve the resulting coupled system.
Yale continues to sponsor and contribute to the International Conference on Theoretical and Computational Acoustics, which provides a forum for the discussion of state-of-the-art development and results in the field of acoustics.

RESULTS

A paper written in collaboration with D. Lee and R. Nagem was published, reporting our results on the elastic model. Preliminary results show agreement with exact solutions in the elastic medium, but more work needs to be done on the numerical solution of the coupled fluid-elastic system.

IMPACT /APPLICATIONS

The FOR3D model and code has been a useful tool for research, application and reference for many users worldwide. We expect that the added capabilities of a fluid-elastic environment will make it even more useful to practicing acousticians.

TRANSITIONS/RELATED PROJECTS

This research project is related to the NUWC IR project entitled "Fluid-elastic Interface

REFERENCES

"Numerical Computations of Elastic Wave Equations," D. Lee, R. J. Nagem, and D. C. Resasco, J. Comp. Acoust., Vol. 5, No. 2, 1997.